

**O & M INSPECTION REPORT
FOR NAVIGATION AND SHORE PROTECTION PROJECTS**

1. Project Name: Hilo Deep Draft Harbor

2. Date of Inspection: May 3, 2004

3. Inspection Personnel:

<u>Name</u>	<u>Agency/Office</u>	<u>Telephone No.</u>
<u>Dan Meyers</u>	<u>COE</u>	<u>438-8875</u>
<u>Jessica Hays</u>	<u>COE</u>	<u>438-1680</u>

4. Findings/Conclusions:

a. Performed the inspection of the Hilo DDH's breakwater. Low tide condition early in the morning progressing to windier and high tide conditions by late morning. The following are deficiencies noted during the inspection:



b. The splash apron is in a deteriorated state since the squatters have removed many of the stones. The painted reach markers are deteriorating or are gone in many instances. They should be repainted.

c. The following is a list of items to monitor:

<u>STATION</u> (P) = Picture in Report	<u>RIB #</u>	<u>SEPARATION (in)</u>	<u>REMARKS</u>	<u>TRIBAR #</u>
0+00			START REACH 1 ROOT	
0+50 (P1)			Armor fallen off OS	
0+50 to 0+70 (P2)			Tree & Bushes on side slope, harbor-side (HS) / crest, many small stones washed up @ crest	
0+60 to 1+00			Uneven side slope, ocean-side (OS)	
1+00 to 3+50			No splash apron, looks peeled off, HS	
2+60			START REACH 2A TRUNK	
3+00			Split armor stone (AS), HS	
3+50 (P3)			START REACH 2B TRUNK	
4+00 (P4)			HS side slope failure	
5+00			START REACH 2C TRUNK	
6+00			Change in side slope, OS	
8+00			Crest w/ 2 split AS. Settling 1/2H:1V	
8+15 (P5)			OS void at crest	
9+25			Exposed underlayer (UL), HS.	
			3 AS at toe dislodged. Settling at crest.	
10+00			HS, Cracked armor stone	
10+05 (P6)			Two voids at centerline (CL) of crest	
10+50			OS, Split armor stone at hinge	
10+75 (P7)			Dislodged AS, OS	
10+95			START REACH 2D TRUNK	
11+15 (P8,P9)	4	1	OS, Monitor tribar movement	727,927,780
11+25 (P10)	5\6	3-6	OS, Tribar Separation, Spalling at chamfer	744,740,140
11+35 (P11)	7\8	3	OS, sideslope steepening, Spalling at chamfer	851
11+45	9\10	7	Spalling at chamfer, no joint material	
11+55 (P12)	12	1		735
11+65	14	3		782
11+75 (P13)	15\16	2,3	Steepening of OS Sideslope	762,748,847
11+90	17	3	Air survey marker	832
11+96	18			
12+12	20	2		838
12+24	21\22	2	Nothing in joint	852\796
12+25	26	4		858

12+68	27\28	7		757
12+80	30\31	2@5		761\775
12+92	32	3	Settling at bottom	953
12+98	33	4	Settling at bottom	792
13+04	34	12	Settling at bottom	738
13+10 (P14)	35	24	Shank break	982
13+16	36	3	Settled and lateral movement	811
13+22	37	6		968
13+28	38	5,6		968,825
13+40	39\40	4		839
13+52	42	4	Spalling at chamfer	770
13+64	43\44	4		981
13+70	45		Spalling bottom of rib cap & chamfer. (Jt)	
			Monitor nearest joint-no filler.	
13+76	46		Spalling at chamfer	
13+88	48		Spalling at chamfer	
13+94	49	12	Air survey marker, mid slope.	643
			Steepening, UL exposed.	
14+00 (P15)			HS stone peeling; see post storm report	
14+06	51\52	2		756
14+18	53	1		583
14+30	55	3		866
14+36	56	12	Spalling at chamfer.	970
	57		Monitor nearest joint-no filler.	
14+60	59\60		Spalling at chamfer.	
14+75			START REACH 2E TRUNK	
14+78	63	2	1st bend in rib cap	402
14+84 (P16)	64		Shank break. New shank break.	513,543
14+90	65	3		516
15+02	67	4		938
15+08	68\69	7		935
15+26	70\71	4	Spalling at chamfer	919
15+30 (P17)	71		Tribar settling and movement	
15+32	72		Air survey marker. Monitor loss of UL. Settling.	
		No tribar @ cap, OS	Able to see water below cap	
(P18)			Dislodged AS at OS water line	
15+38	73\74	12	Begin settled area. Monitor nearest joint	906,920

15+50	75	2		868
15+56	76\77	5,12	End settling. Monitor tribar-tilted	905
15+74	79	12		884
15+80	80	6	Bottom corner sheared off	887
15+98 (P19)	83	7,2	Old air survey marker. 856 is separated	856\889,598
			7" on one side, 18" on other side.	
			Nearest 598 shank break at WL.	
16+16	86	12		400
16+22	87	12		414
16+34	89	5		952
16+40	90	3	Gap/void between	392
16+46	91\92	1	Gap/void between (hole).	404
			? Broken tribar, HS. UL exposed.	
16+58	93	6		403
16+64	94	1		925
16+70	95	1	"Cambra", brass bolt, 2d bend, Loss of joint material	925
			Spalling at chamfer	
16+76	96	2,4		941\955
16+82	97\98		Spalling at chamfer	
17+00	100	2		397\312
17+05	102	3	Spalling	940
17+24	103\104	6		972
17+30	105	5		945
17+36	106	3		939
17+40 (P20)	107\109		3 x shank break (jt location)	unk\317\287
17+42	110	3		957
17+78	113	4		328
17+84	114	2		328\956\958
17+90	115\116	1		251
17+96	116		Air marker survey	
18+02	117	5		942
18+08	118	5		943
18+14	119	3	Loss of joint material	396
18+20	120	8	Spalling at chamfer	227
18+26	121	5		214
18+32	122	5		226
18+38	123	8		410
18+44	124	10		213

18+50	125	12		213
18+56 (P21)	126	9	Crest settling under rib cap	
18+62	127	1		228
18+68	128	1		329
18+74	129	5,1		198\184
18+80	130	1		184
18+86	131	3	Loss of joint material	169
18+92	132	2	WL 2 chipped flukes	263
18+98	133	1	Settling 1H:2V	264
19+10	134\135	1		327
19+16	136	3		156
19+52	142	2		212
19+52 (P22)	142		Shank break 7 ribs from end - 71 sliding. Broken tribar.	64
19+58	143	2	Double layer at WL, Loss of joint material	71
19+64	144	1		66
19+70	145	4		62
19+76	146	4		62
19+82	147	6		58
19+90	149	6	Rib cap end. Air survey marker.	255
19+91			START REACH 2F TRUNK	
21+90 (P23)			Partial Air survey marker	
22+80 (P24)			Missing hinge stone on HS	
22+90 (P25)			Fractured crest stone	
23+90 (P26)			Air survey marker. 50' reach. Settling, OS.	
24+90			End reach.	
25+00 (P27)			START REACH 2G TRUNK, monitor hinge separation, OS.	
25+30 (P28)			Slight separation at crest hinge, OS.	
			Monitor possible sliding.	
25+85 (P29)			Crest void	
25+90			Air marker survey	
26+49 (P30)			Cracked AS on HS hinge	
27+28 (P31)			OS, hinge settling	
27+90			Air marker survey (not found in '04 insp.)	
28+54 (P32)			Settling at centerline of crest	
28+78 (P33)			OS, Sideslope steepening/settling	
28+80		PS GONE this inspection	Perched stone (PS), void at crest, UL exposed	

29+38 (P34)			Depression on crest, 5' diameter, hinge settling w/ UL exposed, adj. green $\frac{3}{4}$ " pipe	
30+00			START REACH 2H TRUNK, Air survey marker	
30+75		Gone	Rocker on crest 2' dia.	
32+00			Air survey marker	
32+25 (P35)			Void, AS separation at HS hinge	
33+66 (P36)			Void at crest	
33+90			Air survey marker (not found in '04 insp.)	
34+10			60' reach with settling at crest opposite	
			green can	
34+90			End reach, 35+00	
35+00			START REACH 2I TRUNK	
35+84 (P38)			3'x4' void, UL exposed at crest	
35+90			Perched rock gone. 3'x4' void at crest	
36+00			Air survey marker (not found in '04)	
36+10 (P39)			50% crest on HS has settled ~5ft	
36+50		4' x 2'	6' deep void at crest (not found in '04)	
36+75			Air Cross (not found in '04)	
37+25 (P40)			Bridging of AS on OS and HS.	
(P41)			Monitor slight crest settlement of side	
			slope (sliding), OS; HS voids	
38+00			Air survey marker	
38+50			Settling @ crest, void, UL missing	
38+85 (P42)			Settling at crest CL; 2 perched AS	
40+00			START REACH 2J TRUNK	
40+00			Air survey marker, end reach	
40+55 (P43)			Bridging and settling at crest, shifting & bulge, OS, noted FY01 Inspection	
42+00			Air survey marker	
42+50 (P44)		HS	Possible dislodged stone at WL	
			Not noted during this inspection.	
			Continue to monitor.	
43+80 (P45)			Voids (3ea.) and AS Separation	
44+10			2'x3' void at crest.	
			Many 10-50 LB stones between AS for 100'	
			Slight settling at crest, bridging of AS, HS	
			High energy area?	
45+00			START REACH 2K TRUNK	

45+80			Bridging of crest stone.	
47+00			Split AS on crest.	
48+29(P46)			Split AS on crest	
(P47)			Dislodged AS 25ft from HS at water level (5x)	
49+15 (P48)			OS, Cracked AS at hinge	
50+00		Marker	START REACH 2L TRUNK	
50+00			End reach	
50+70			Bridging of crest stone.	
52+60 (P49)			Bridging of crest stone and settling	
52+75 to 52+95 (P50)			Perched stone on crest 3' diameter; separation of AS on OS	
54+00 (P51)			Fractured AS at crest	
54+30 (P52)			Fractured AS at crest (New in '04)	
54+50 (P53)		5'L x 3'W x 5'D	OS, separation of armor stones at hinge causing void	
54+75 (P54)			OS, 1 AS w/ 2 splits at hinge	
55+00			START REACH 2M TRUNK	
55+25 (P55)			OS, AS settling and separating at hinge	
56+10			OS, 4' void depth, UL settling at hinge	
57+00			2' separation at slope/crest hinge	
Several small			1 st 100' side slope looks steeper	
UL perched			High energy area, limu on crest	
OS hinge (P56,P57)			Frequent overtopping	
			Monitor crest settlement	
57+35 (P58)		4'D x 4'W x 2'L	OS void	
57+58 (P59)			2ft separation of CL AS	
59+82 (P60)			Void and settling to OS hinge	
59+00		5'D x 2'W x 6'L	Void - End reach. 2d big bend in breakwater	
59+30			Bridging and settling at crest	
60+00			START REACH 2N TRUNK	
60+00			Large cavity (10'x5') due to bridging	
			Little contact at crest.	
60+80 (P61)		2' x 4' x 4'	Void @ HS of crest	
61+13 to 61+50			Numerous AS separations and voids. Monitor area.	
62+00 (P62)			1'x3' perched stone on crest	
62+30 to 63+50 (P63)			OS hinge bowing out	

65+00			START REACH 2O TRUNK	
65+00 (P64)			Slight settling on OS slope, bridging	
			Area of wave focusing	
66+00			End reach	
66+17 (P65)			Cracked AS	
66+35 (P66)			2' void on crest, exposed UL	
67+19 (P67)			2'x3'x4' void, separating AS at OS hinge	
68+45			2' void at PC of bend	
68+78 (P68)			Tombstone - flat AS flipped up on OS hinge	
69+00			OS, Monitor settling at hinge	
69+98 (P69)			3'x4' void 10' deep down to waterline.	
			Loose AS, HS	
			PC etched into stone at 70+00	
70+00			START REACH 2P TRUNK	
70+50			Brass disk - unknown inscription. (not found 04)	
			20'x10' depression, OS, monitor	
71+00			Air survey marker (not found in '04)	
71+10 (P70)			3'x5' void, OS	
72+00 (P71)			End reach. Slight settling at crest hinge, OS	
73+00 (P72)			Slight settling at crest and bulge, HS	
73+64			Slight settling at crest and bulge, HS	
74+40 (P73)			3 fractured stones at crest.	Verify loc'n
			Not found '98 inspection	
75+00			START REACH 2Q TRUNK	
75+20			Separation at slope-crest hinge. UL exposed. Not found in '04 inspection	
75+85 (P74)			1 small crest stone fractured. 3x	verify loc'n
77+00			End reach	
77+30			Bridging at crest	
77+80			Cracked AS on Center Line of crest	
78+80 (P75-77)			Depression, bridging at OS hinge	
80+00			START REACH 2R TRUNK	
81+34 (P78)			Voids at OS crest	
81+47 (P79)			Void at crest CL	
81+50			Air survey marker adjacent red can	
81+61 (P80)			Void on HS	
82+00			End reach	

82+17			Marker?	
82+75			Possible dislodged AS at WL	
83+00-84+00			Poor key and fit of crest stones.	
			Not interlocked/touching adjacent stones	
84+30		5'L x 3'W x 8'D	Crest separation of several armor stones w/ UL exposed causing void	
85+00			START REACH 2S TRUNK	
85+00 to 92+00			Bridging of crest stones. Settling of hinge at various locations	
87+00			End reach, Settling hinge	
87+80			OS, Crest w/ void down to WL, UL exposed	
90+00 (P81)			START REACH 2T TRUNK (white cross), Settling at hinge w/separation	
91+25			Fractured stone at crest, Settling hinge	
92+00			End reach, Settling hinge	
92+75			Settling hinge approx. end	
92+20 (P82)			Voids (chinker present at other areas gone)	
			Fractured crest stone, no interlock, bridging	
			AS protruding from slide slope, HS	
92+20-93+70			Noticeable 1'-2' recession at WL-150 LF	
92+90			OS, void from crest to WL	
93+00			OS, void from crest to WL	
93+77 (P83)			Dislodged AS at hinge	
93+90			2'x3'x10' void near crest, OS	
95+00			START REACH 2U TRUNK	
95+78 (P84)			Perched stone on OS	
96+25			NOS disk "7741B 1976"	
97+40			NOS disk "7741A 1976"	
98+25			NOS disk "7741C 1976"	
99+17			NOS disk "7741D 1976"	
99+85 (P85)			START REACH 3 HEAD	
100+05			Settling, missing AS at WL, HS	
100+25			Settling, 1' gap between AS (WL to crest)	
100+35			Perched stone on crest not found FY01	
			Monitor head closely for future changes	
			Profile appears to have changed (lost AS)	
			since last inspection	
100+55 (P86)			Void	
100+65 (Px3)			END REACH 3 HEAD	



P1. Sta. 0+50, OS, Armor stones dislodged from hinge and resting on sideslope



P2. Sta. 0+50 – Sta. 0+70, Vegetation, remove perched armor stones resting on crest.



P3. Sta. 3+50, Overview



P4. Sta. 4+00, Harbor Side Failure of Side Slope, monitor.



P5. Sta. 8+15, Void on OS of crest



P6. Sta 10+05, Two voids at centerline of crest



P7. Sta. 10+75, OS, Monitor dislocated armor stone resting on the sideslope.



P8. Sta. 11+15, OS 1" separation (tribar #727)



P9. Sta 11+15, OS, Monitor tribar movement.



P10. Sta. 11+25, OS, 3-6" separation (tribar #740 and #744)



P11. Sta. 11+35, OS, 3" separation (tribar #851). Sideslope steepening.



P12. Sta 11+55, OS, 1" separation (tribar #735).



P13. Sta. 11+75, OS, Monitor tribar movement.



P14. Sta. 13+10, OS, Broken Tribar # 738



P15. Approx. Sta 14+00, Peeling of stone on HS, see post-storm report



P16. Sta. 14+84, OS, Shank Break.



P17. Sta.15+30 to 15+56, OS, Monitor tribar movement.



P18. Sta 15+32, Dislodged stone at ocean side toe



P19. Sta.15+98, OS, Monitor shank break at water line.



P20. Sta. 17+40, OS, Broken Tribars # 317 / 287 / ?



P21. Sta. 18+56, Settling under tribar ribcap, monitor.



P22. Sta. 19+52, OS, Broken Tribar # 64



P23. Sta 21+90, Partial Air Survey Marker



P24. Sta 22+80, Missing harborside hinge stone



P25. Sta 22+90, Fractured crest stone



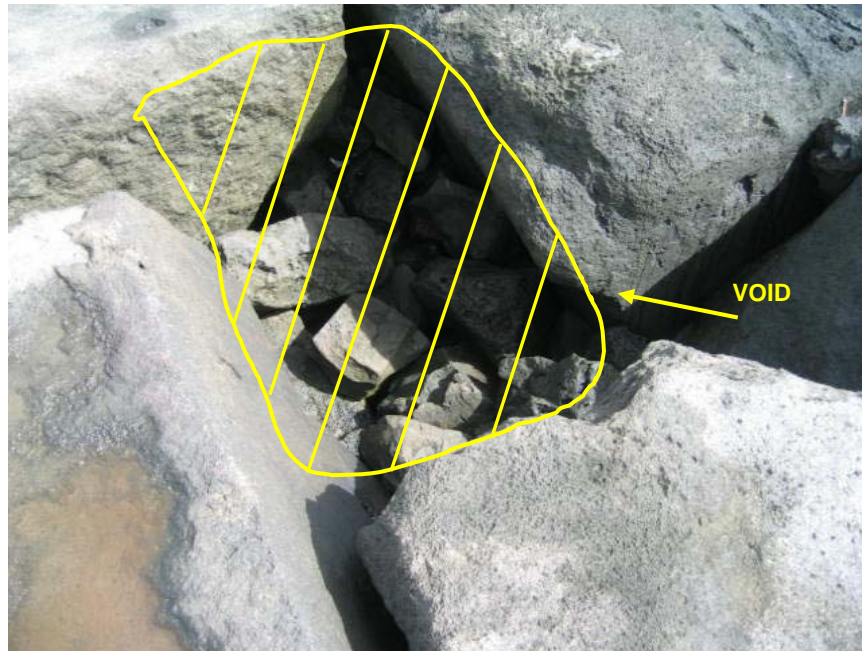
P26. Sta 23+90, Oceanside settling



P27. Sta 25+00, Oceanside hinge separation



P28. Sta 25+30, Slight separation at Oceanside hinge



P29. Sta 25+85, Small crest void



P30. Sta 26+49, Cracked armor stone on harborside hinge



P31. Sta. 27+28, OS, Monitor hinge settling.



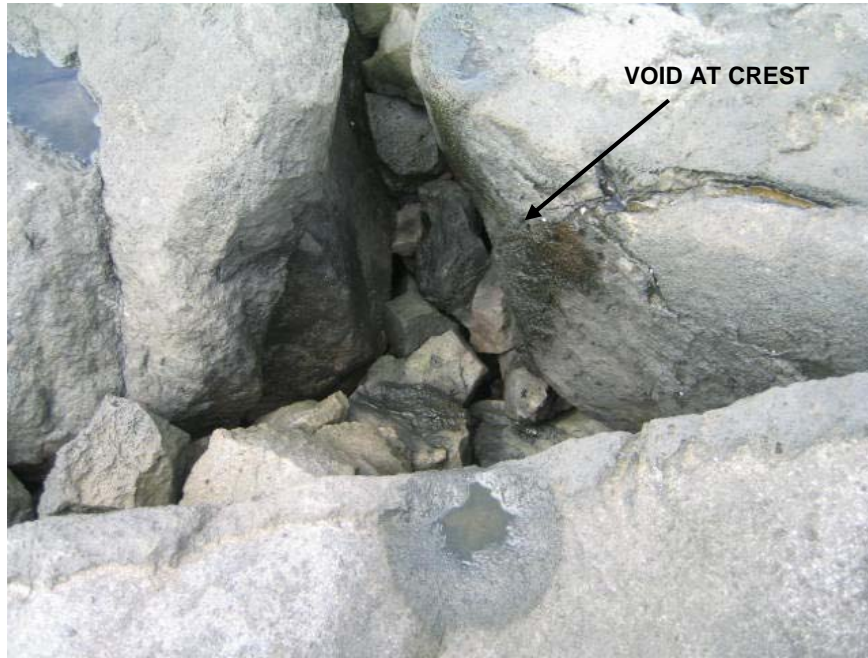
P32. Sta. 28+54, Settling at centerline of crest



P33. Sta. 28+78, OS, Settling at hinge/sideslope



P34. Sta. 29+38, Depression on crest



P35. Sta. 32+25, Void on crest



P36. Sta. 33+66, Void on crest



P37. Overview from Sta 35+00



P38. Sta. 35+84, 3'x 4' void at crest, UL exposed.



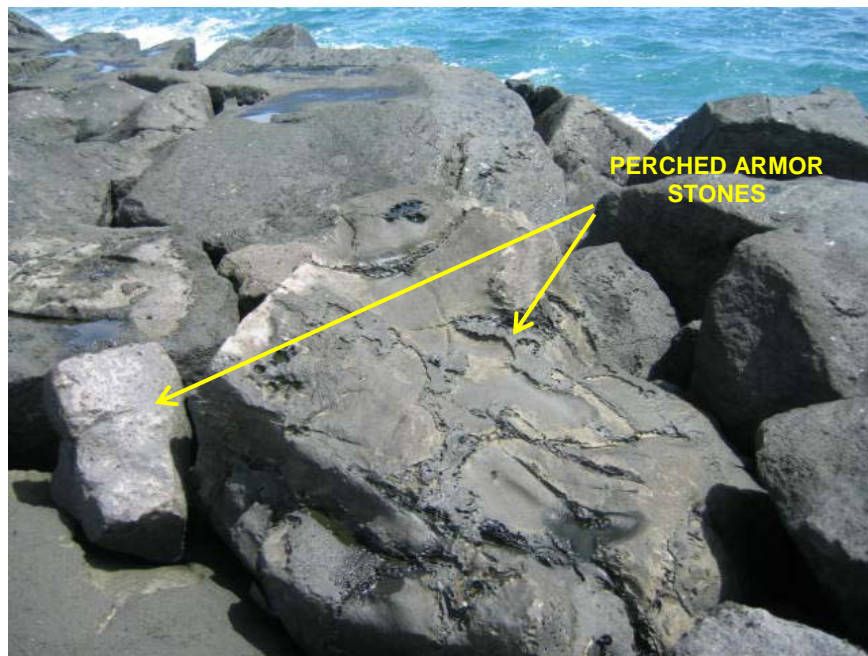
P39. Sta. 36+10, 50% of crest on harborside settled ~ 5ft



P40. Sta. 37+25, OS, Bridging armor stone.



P41. Sta. 37+25, Settling at crest, two HS voids.



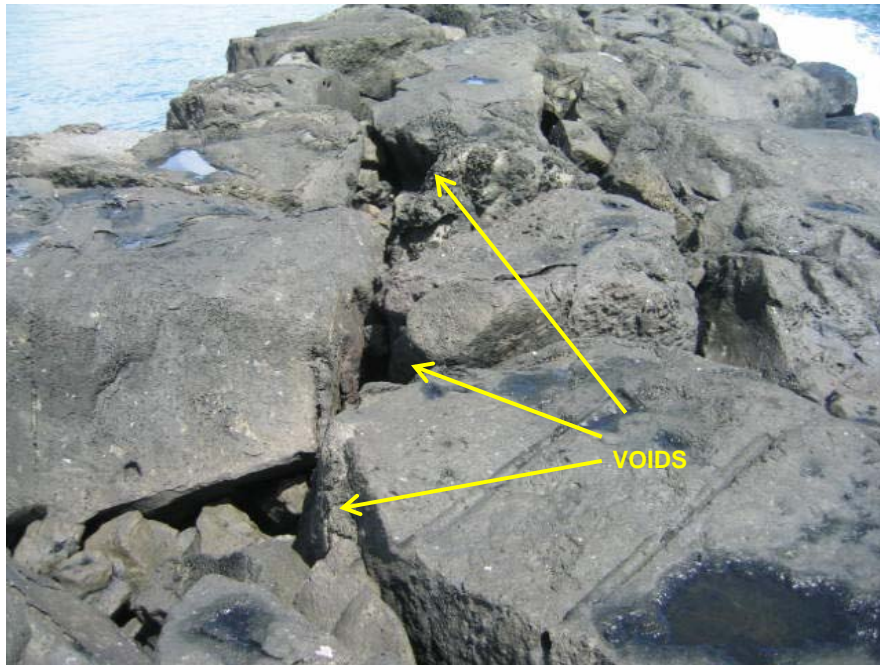
P42. Sta 38+85, Two perched Armor stones



P43. Sta 40+55, Bridging and settling at crest



P44. Sta. 42+50, OS, Possible dislodged stone at WL. (2003 photo)



P45. Sta. 43+80, 3 Voids and armor stone separation.



P46. Sta. 48+29, Split armor stone.



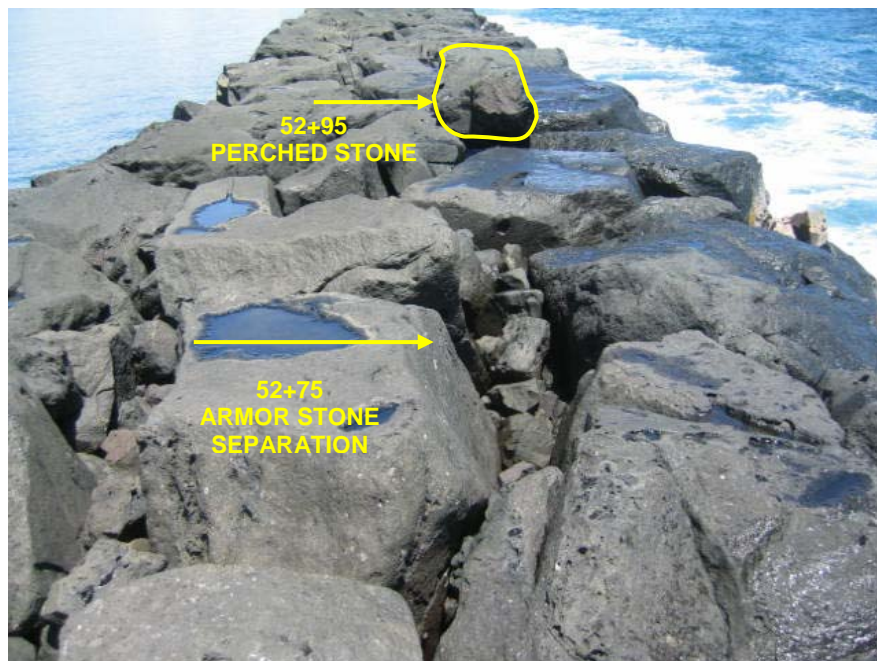
P47. Dislodged armor stones on harborside, 25 ft from structure.



P48. Sta. 49+15, OS, Cracked armor stone at hinge.



P49. Sta. 52+60, Bridging of crest stone.



P50. Sta. 52+75 to 52+95, OS, Perched armor stone resting on the crest. Separation of crest due to wave forces with rocks being tossed up from the ocean and wedging between the armor stone's contact keeping them apart.



P51. Sta. 54+00, Fractured armor stone at crest.



P52. Sta. 54+30, Fractured armor stone at crest.



P53. Sta. 54+50, Crest, Hinge separation w/ void 5'L x 3'W x 5'D. (2003 Photo)



P54. Sta. 54+75, OS, 1 armor stone at hinge with 2 splits. (2003 Photo)



P55. Sta. 55+25, Oceanside separating at hinge.



P56. Sta. 57+00, Several small underlayer stones perched on oceanside hinge.



P57. Sta 57+00, Steepened harborside slope



P58. Sta. 57+35, 4ft x 4ft x 2ft void on oceanside



P59. Sta. 57+58, 2ft separation on armor stone at centerline



P60. Sta 59+82, OS, Settling to oceanside hinge



P61. Sta 60+80, Void at harborside of crest



P62. Sta 62+00, 1' x 3' perched stone on crest



P63. Sta 62+30 to 63+50, Oceanside hinge bows out



P64. Sta 65+00, Bridging and settling on oceanside slope



P65. Cracked armor stone on crest



P66. Sta 66+35, 2 ft void on crest and exposed underlayer



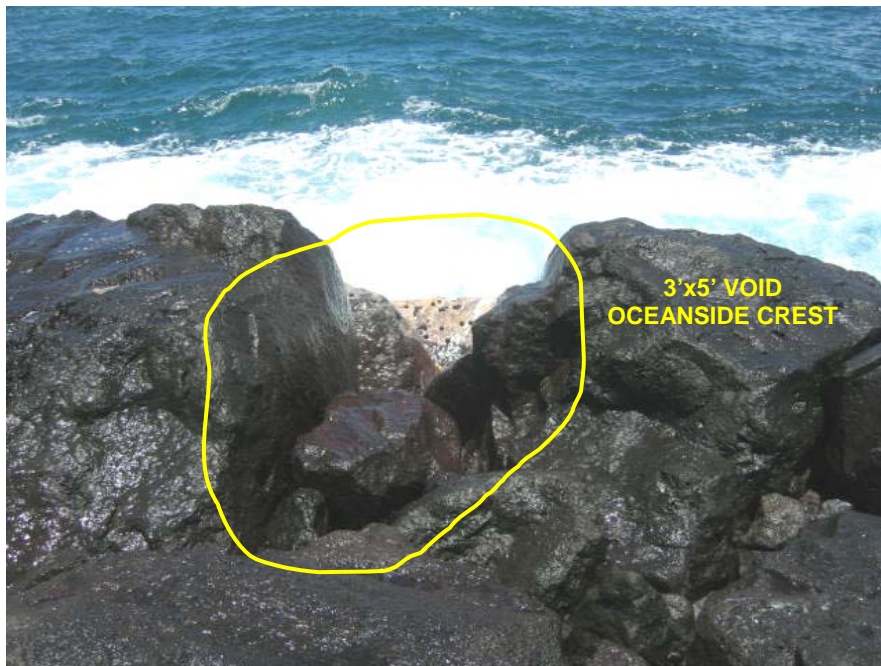
P67. Sta 67+19, OS, 2'Wx3'Lx4'D void at oceanside hinge



P68. Sta. 68+78, Perched armor stone resting on oceanside crest, "Tombstone".



P69. Sta 69+98, HS, 3'x4' void extending 10' down to waterline



P70. Sta 71+10, OS, 3ft x 5 ft void on oceanside of crest



P71. Sta. 72+00, OS, Monitor settling at hinge.



P72. Sta 73+00 to 73+64, HS, Slight settling at crest and HS bulge



P73. Sta. 74+40, Crest, one of 3 fractured armor stones in this area.



P74. Sta. 75+85, Crest, 1 small armor stone fractured 3x.



P75. Sta. 78+80, OS, Bridging at hinge



P76. Sta. 78+80, OS, Bridging at hinge



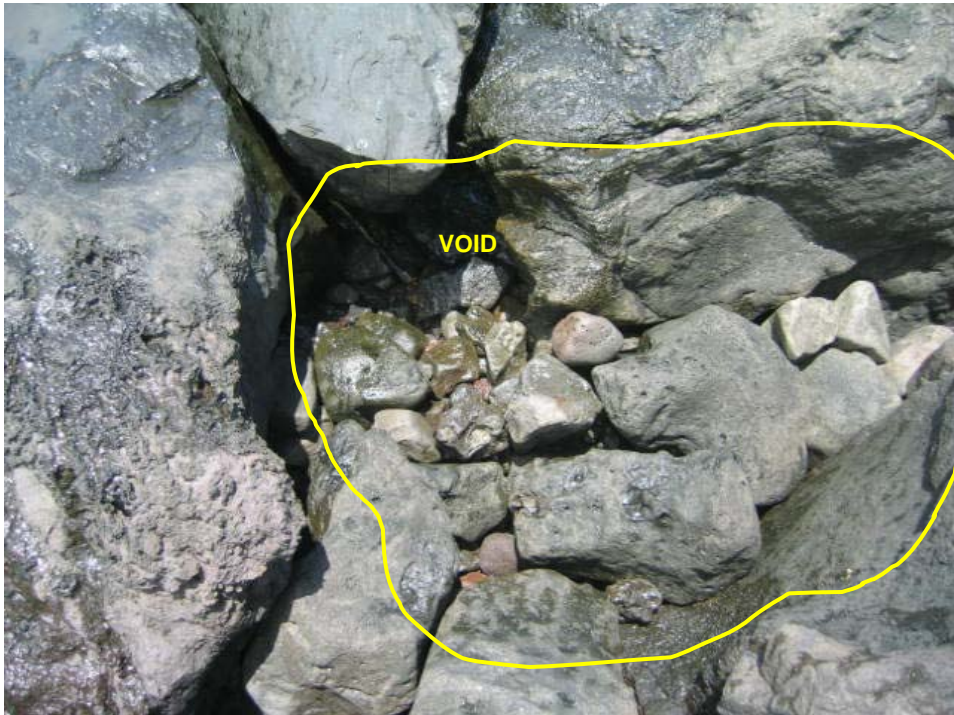
P77. Sta. 78+80, OS, Bridging at hinge



P78. Sta. 81+34, OS, Void at crest.



P79. Sta. 81+47, Void at centerline exposing underlayer.



P80. Sta. 81+61, HS, Void exposing underlayer.



P81. Sta. 90+00, OS, Settling at hinge with separation.



P82. Sta. 92+20 to end, Overview. (2003 Photo)



P83. Sta. 93+77, OS, Dislodged armor stone at hinge.



P84. Sta. 95+78, OS, Perched stone on crest.



P85. Sta. 100+00, Overview to end. (2003 photo).



P86. Sta. 100+50, HS, Overview facing root.



P87. Sta. 100+65, Overview of head at 45 degrees harborside.



P88. Sta. 100+65, Overview of head at 0 degrees.



P89. Sta. 100+65, Overview of head at 45 degrees oceanside.

5. Conclusion:

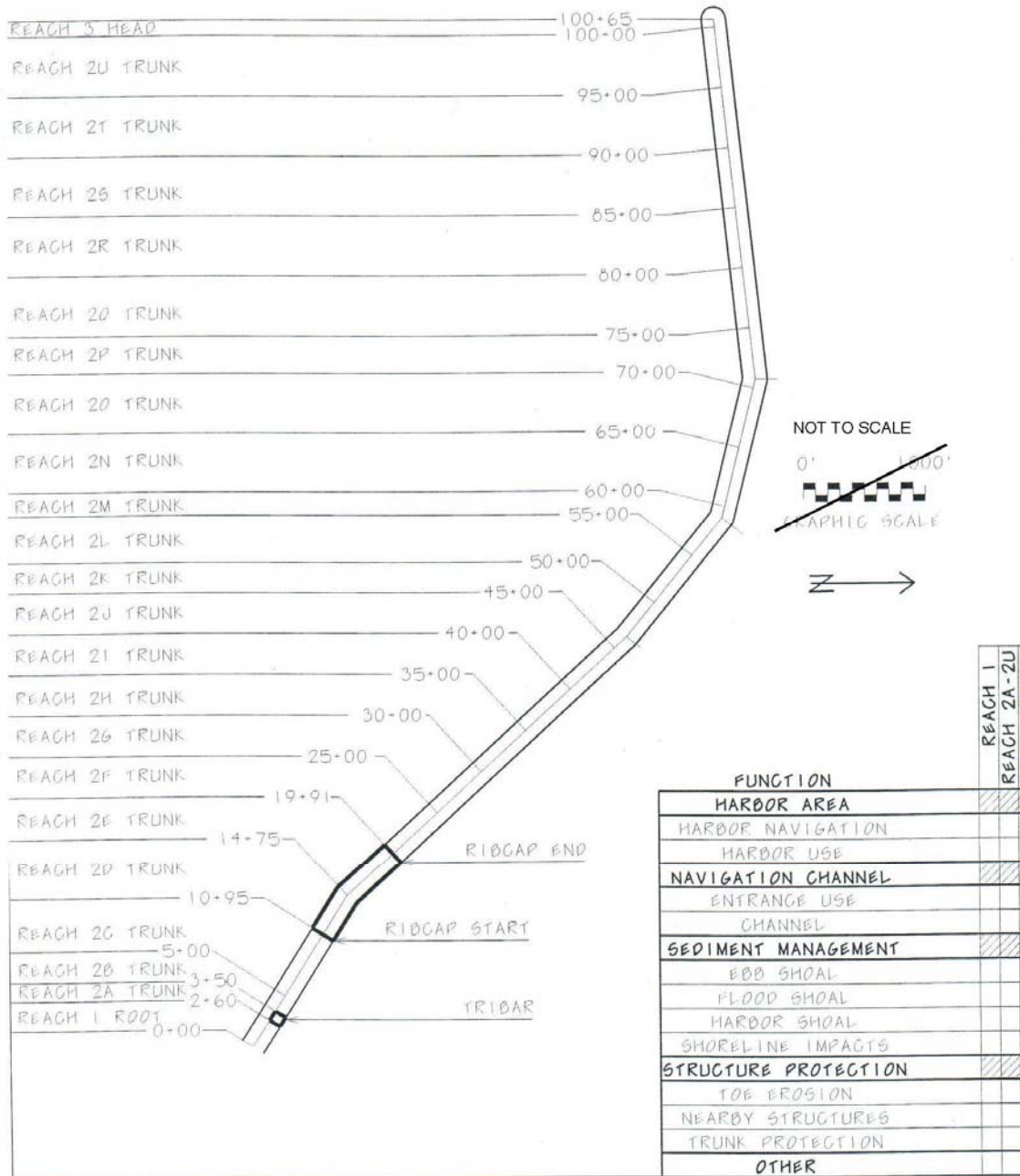
There were new deficiencies noted during this inspection. The most significant were dislodged stones and separation at crest hinges and dislodged stones from structure toe. The overall condition of the breakwater is FAIR, however the functionality is GOOD.

Recommend adding permanent brass survey monuments at every 500' with **station** numbers on them after the end of the concrete rib section.

Signed: _____
Jessica Hays, CEPOH-EC-T

Signed: _____
Jim Pennaz P.E., Ch, CEPOH-EC-T

HILO BREAKWATER



HILO HARBOR, HAWAII, HAWAII

CONDITION OF IMPROVEMENT 30 SEPTEMBER 1993

PREVIOUS PROJECTS: Authorized by the River and Harbor Acts of 2 March 1907, 25 July 1912 and 3 March 1925.

EXISTING PROJECT: Modification authorized by the Water Resources Development Act of 1986 (PL 99-662), 17 November 1986, provides for deepening the entrance channel from 35 feet to 39 feet and deepening the turning basin from 35 feet to 38 feet.

PROGRESS OF WORK

Completed and Under Maintenance: Work authorized by the Acts of 1907, 1912 and 1925 was completed in 1930. Emergency breakwater repair was completed in 1968. Other breakwater repairs were completed in 1973, 1975 and 1981. Last maintenance dredging was completed in April 1990; total material dredged was 80,000 cubic yards.

Work Remaining: None. Preconstruction engineering and design on modification authorized in 1986 and initiated in FY 1990, was terminated in July 1991. Project was determined to be economically unjustifiable. Project placed in deferred category in FY 1992.

COST OF CONSTRUCTION:

	<u>New Work</u>	<u>Maintenance</u>	<u>Total</u>
<u>Completed Works:</u>			
United States Funds	\$5,423,440	\$4,089,631	\$9,513,071
Total Costs	\$5,423,440	\$4,089,631	\$9,513,071
<u>Uncompleted Works:</u>			
United States Funds	\$4,570,000		\$4,570,000
Contributed Funds Required	1,530,000		1,530,000
Total Estimated Costs (1990)	\$6,100,000		\$6,100,000

RANGE OF TIDES: The range of tide between mean lower low water and mean higher high water is 2.4 feet. The extreme range is 5.4 feet.